



Leveraging Aircraft Avionics for Fleet and Airport Management

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Abstract

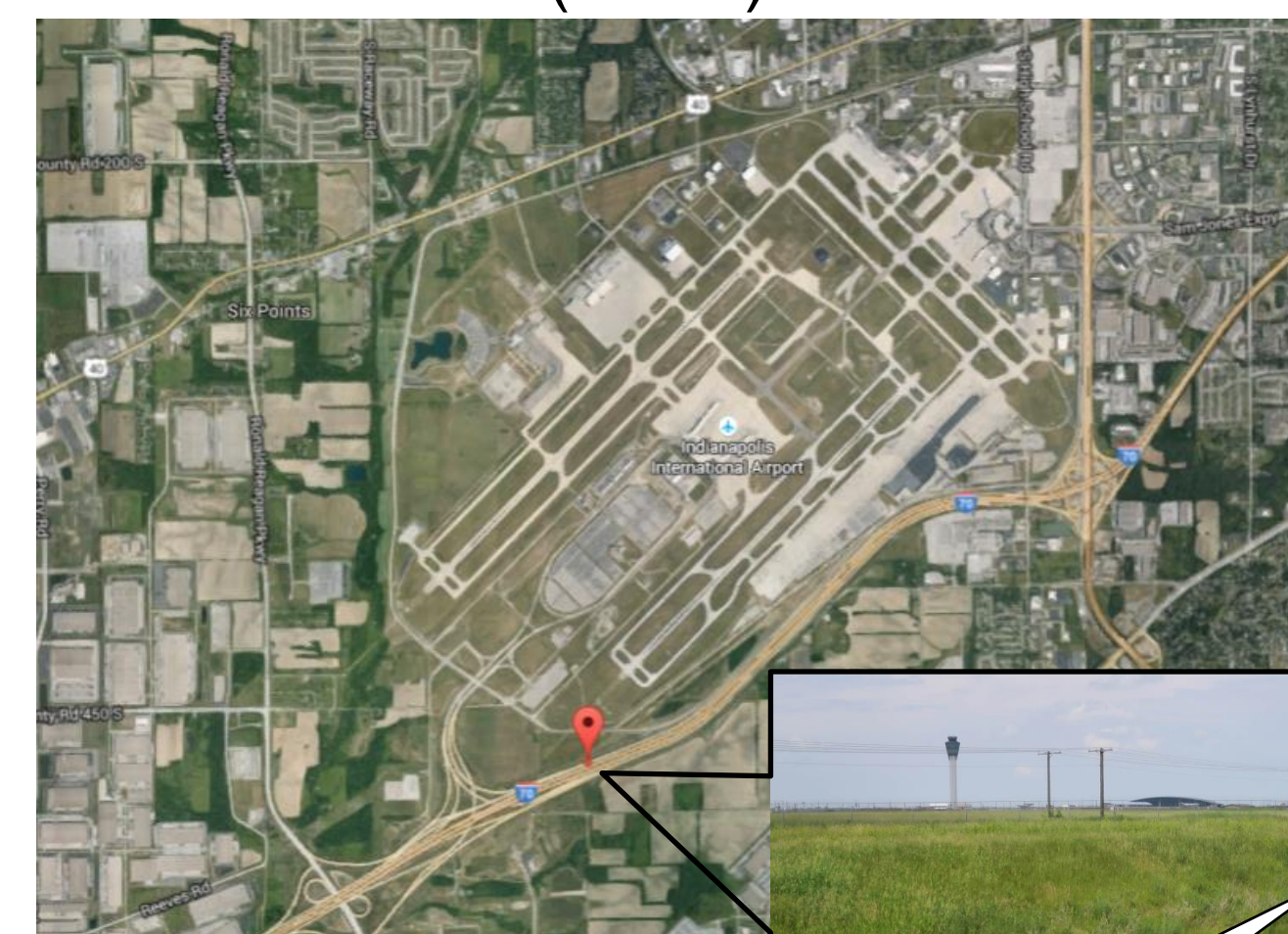
Airport operations count data are used for a variety of purposes ranging from allocation of Airport Improvement Program (AIP) funding to environmental assessments and budget justification. Operations counts are hard to obtain at small, non-towered airports, which constitute the majority of airports in the United States, and are frequently estimated unscientifically by airport managers. Current acoustic and video counting technology is limited, but with the FAA NextGen mandate for installation of ADS-B Out transponders by Jan. 1, 2020, transponder data is rapidly emerging as a viable data source beyond traditional NextGen applications. To date, the NextGen literature has focused on the use of this technology for navigation, safety, and airspace management. This paper introduces a method of applying ADS-B data to fleet management and airport operations. With a 1090 MHz receiver and appropriate signal processing hardware and software, Mode S and Mode S Extended data can be used to track runway operations and fleet usage in an accurate and cost-effective manner.

Data Collection

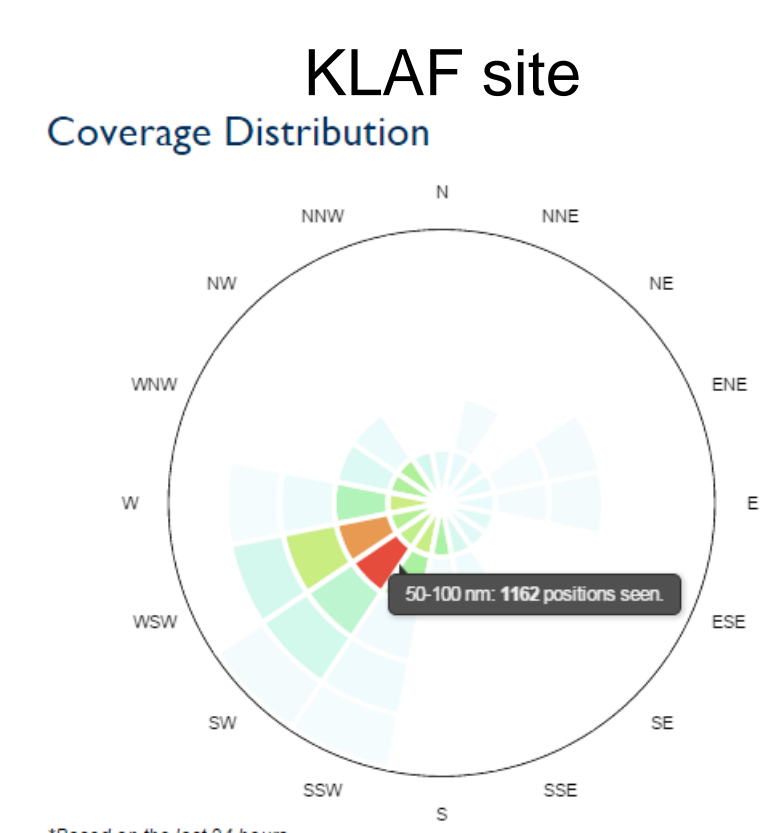
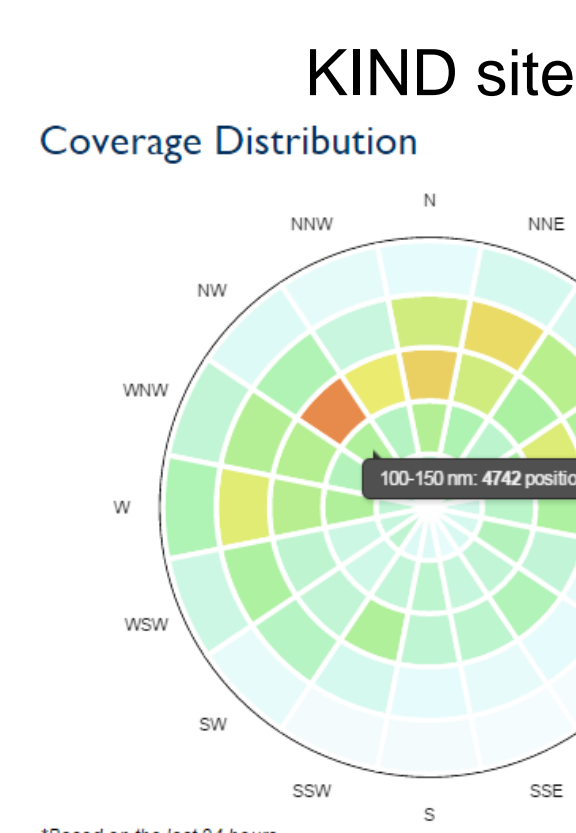
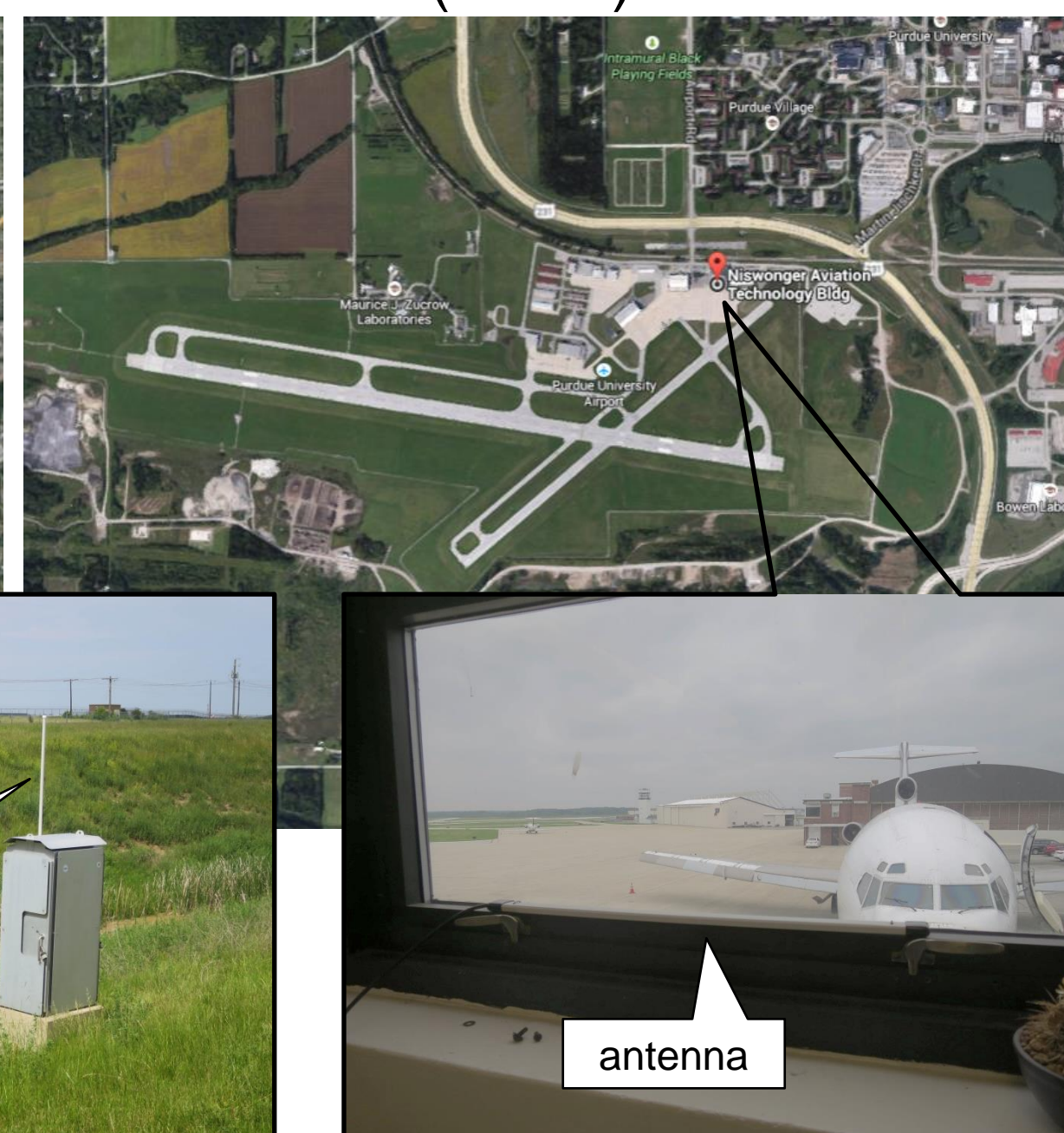


Data for this analysis were collected with a Raspberry Pi, a small computer that runs Linux, using a USB software-defined radio with a vertically-polarized, half-wave dipole antenna. The assembly can be battery powered and portable (left) or permanently installed (below). The data received is dependent on antenna size as well as attenuation due to buildings.

Indianapolis International Airport (KIND)



Purdue University Airport (KLAF)



	Sun 06/07	Mon 06/08	Tue 06/09	Wed 06/10	Thu 06/11
Positions reported	102,387	216,031	257,075	65,757	9
Aircraft seen	1,322	2,548	2,910	675	1

Coverage is a function of antenna strength and attenuation. The KIND site has a larger antenna placed outside, whereas the KLAF antenna is attenuated by the building and gets most positions from the southwest.

Cirrus Fleet Utilization at Purdue University Airport (KLAF)



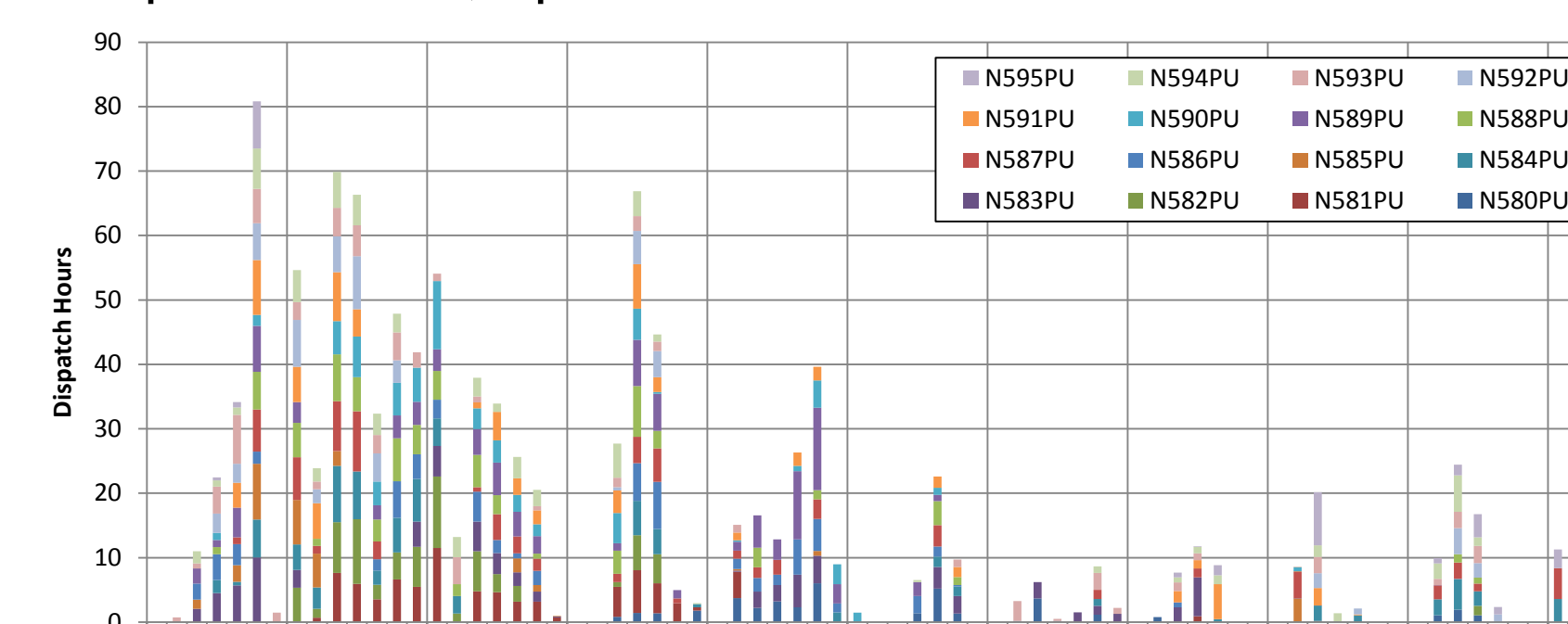
Purdue University maintains a fleet of 16 Cirrus aircraft to support its flight training program, including a bachelor's degree program in professional flight. Performance metrics include:

- Dispatch hours for each plane
- Planes used in a day
- Flight slots being used
- Flight time using Visual vs. Instrumented Flight Rules (VFR/IFR)
- Days an aircraft isn't used
- Number of turns
- Unutilized turn time
- Ground departure/arrival time

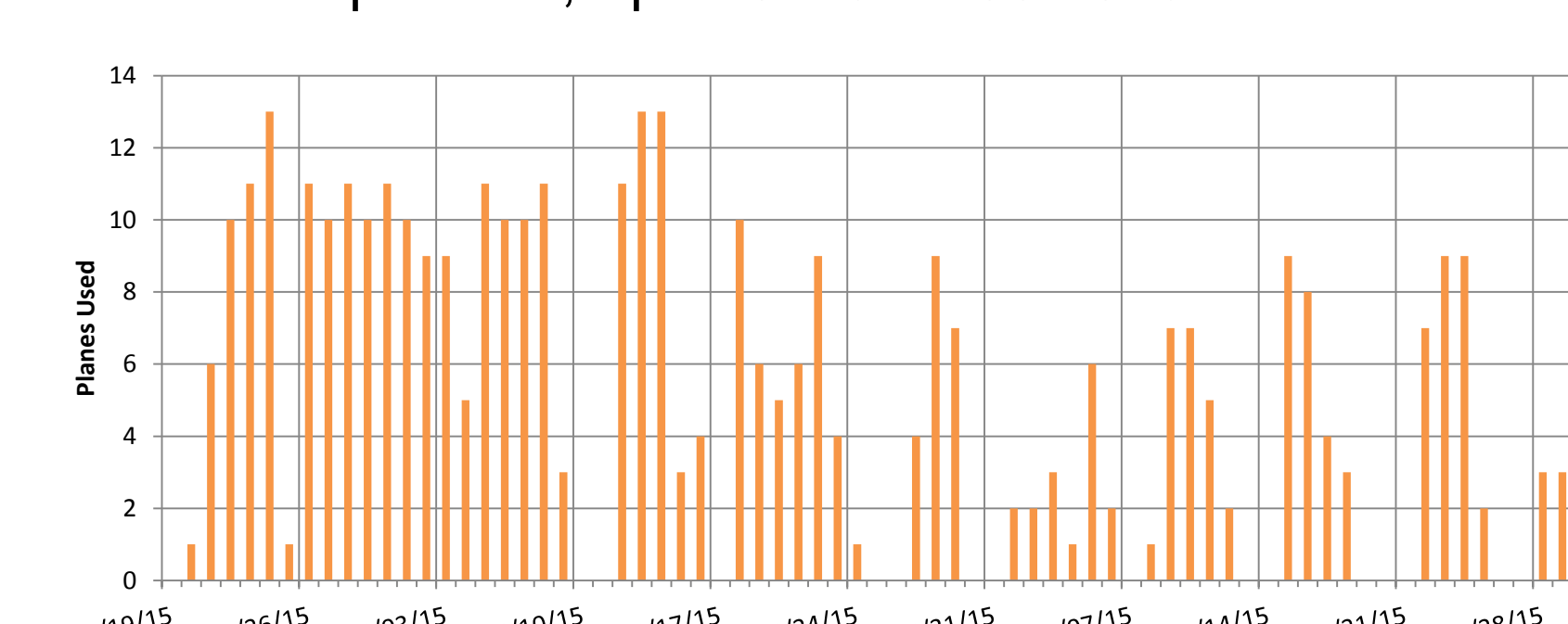
Comparison of low- and high-use days with dispatch hours by two-hour flight blocks

	04/27/15												04/28/15											
NS81PU																								
NS82PU																								
NS83PU																								
NS84PU																								
NS85PU																								
NS86PU																								
NS87PU																								
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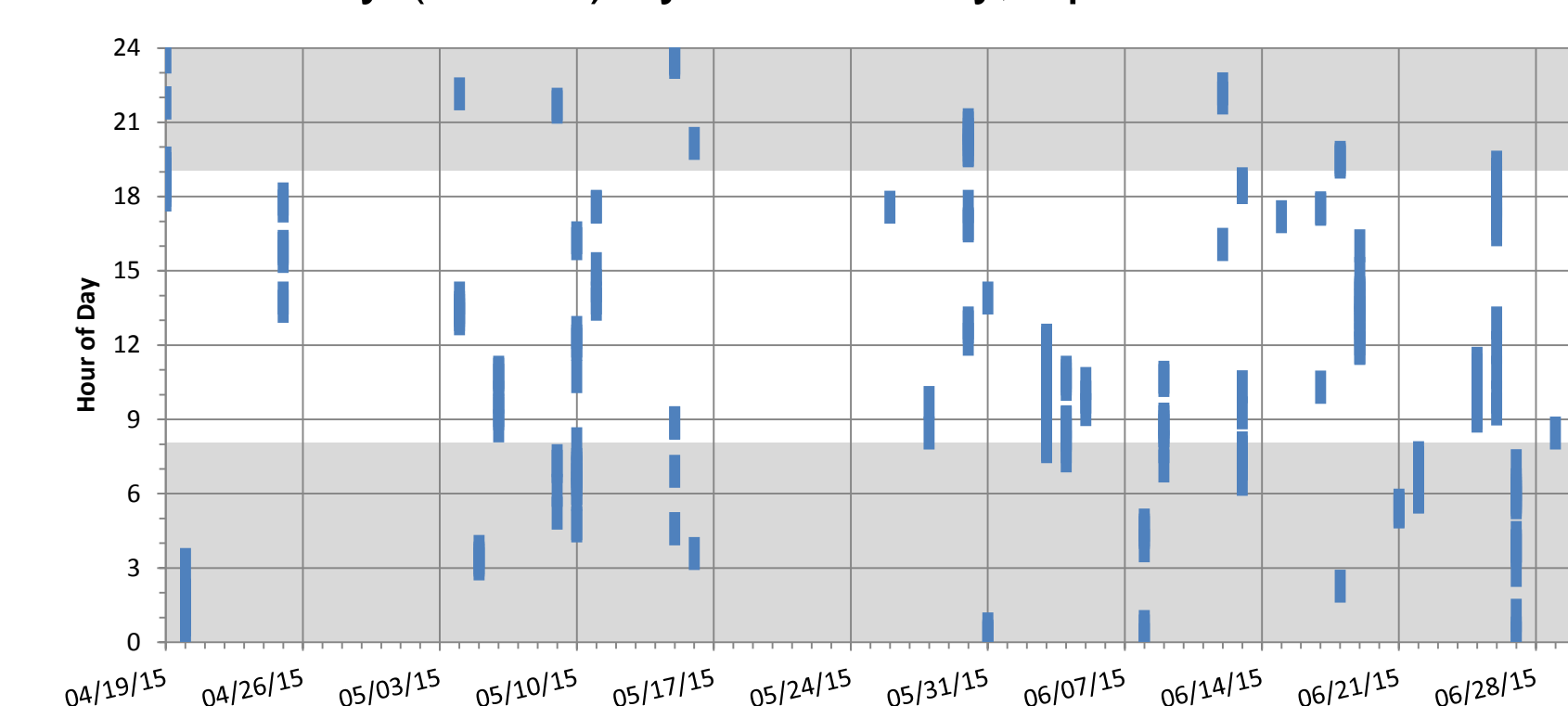
Dispatch Hours, Apr. 19 – Jun. 30 2015



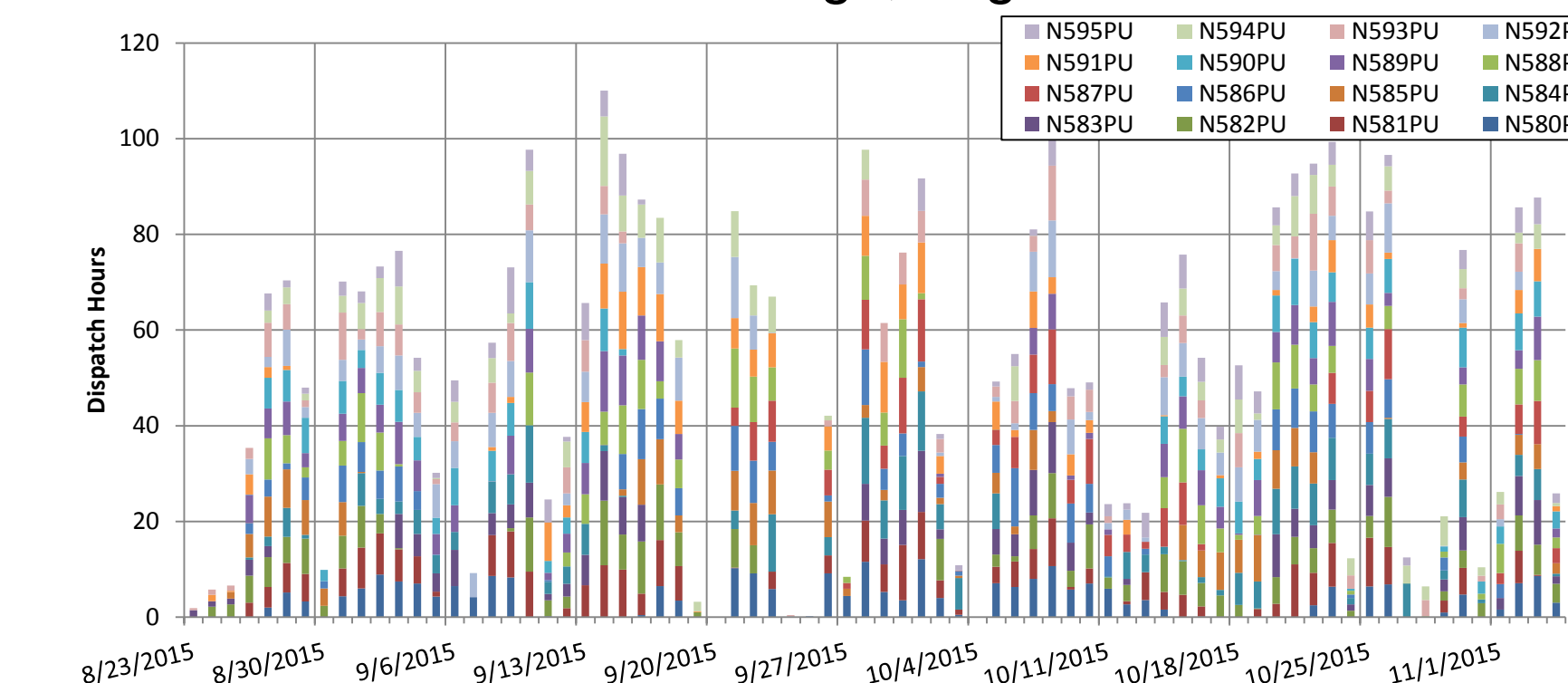
Aircraft Dispatched, Apr. 19 – Jun. 30 2015



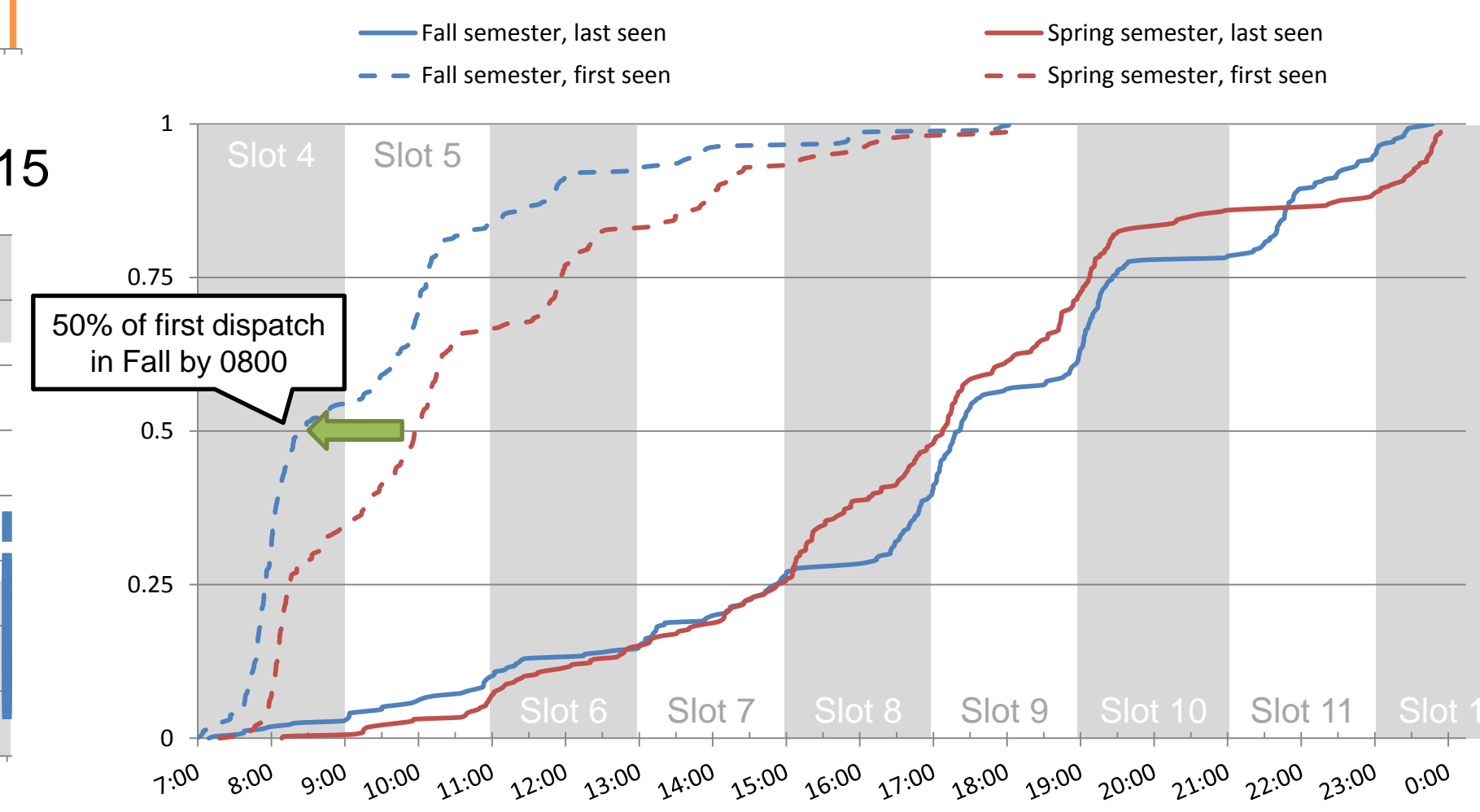
Low visibility (< 3 mi) by hour of day, Apr. 19 – Jun. 30 2015



Fall semester increase in usage, Aug. 23 – Nov. 4 2015

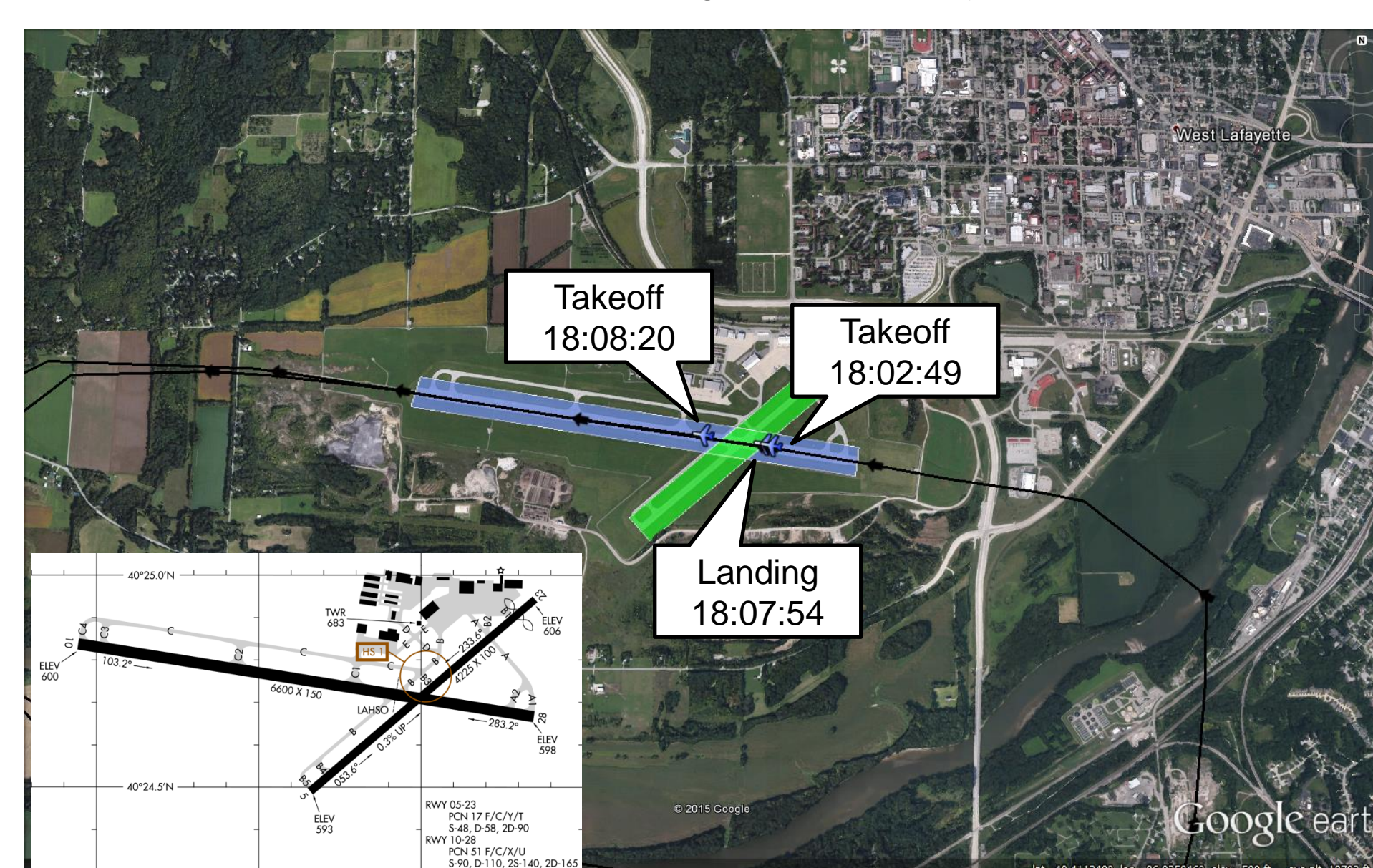


Purdue increased enrollment in the incoming class from 55 to 71 students, and aircraft dispatch hours have increased in the fall semester as compared to the spring semester. The cumulative frequency distributions below show aircraft operations are generally beginning earlier and ending later in the day:

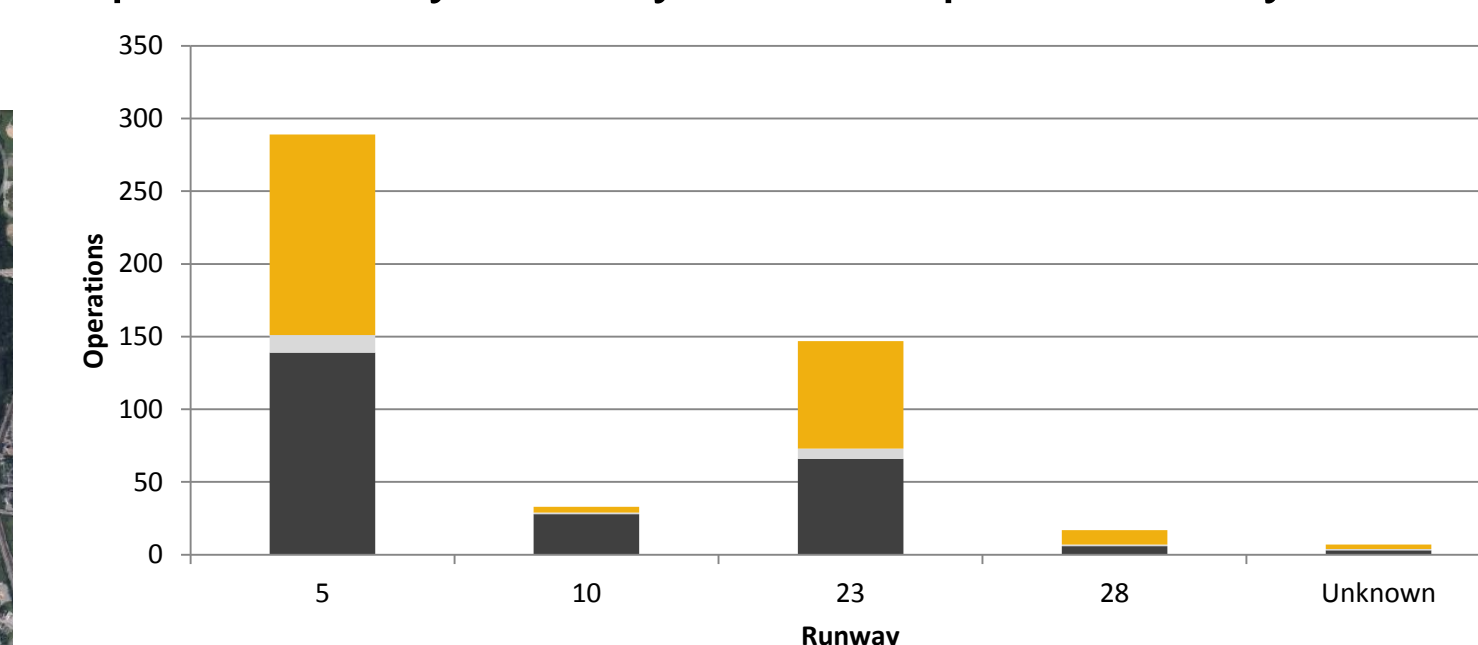


Airport Operations

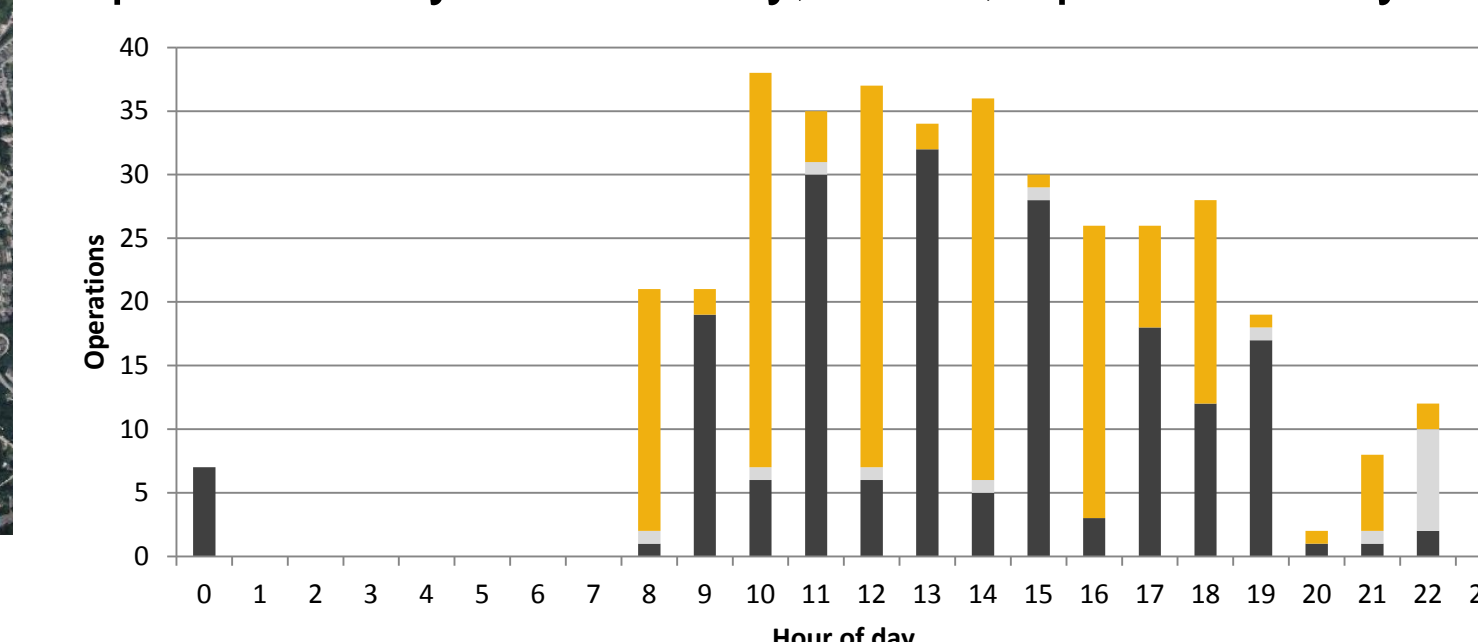
N586PU, takeoff and touch-and-go on Runway 28, Sept. 3



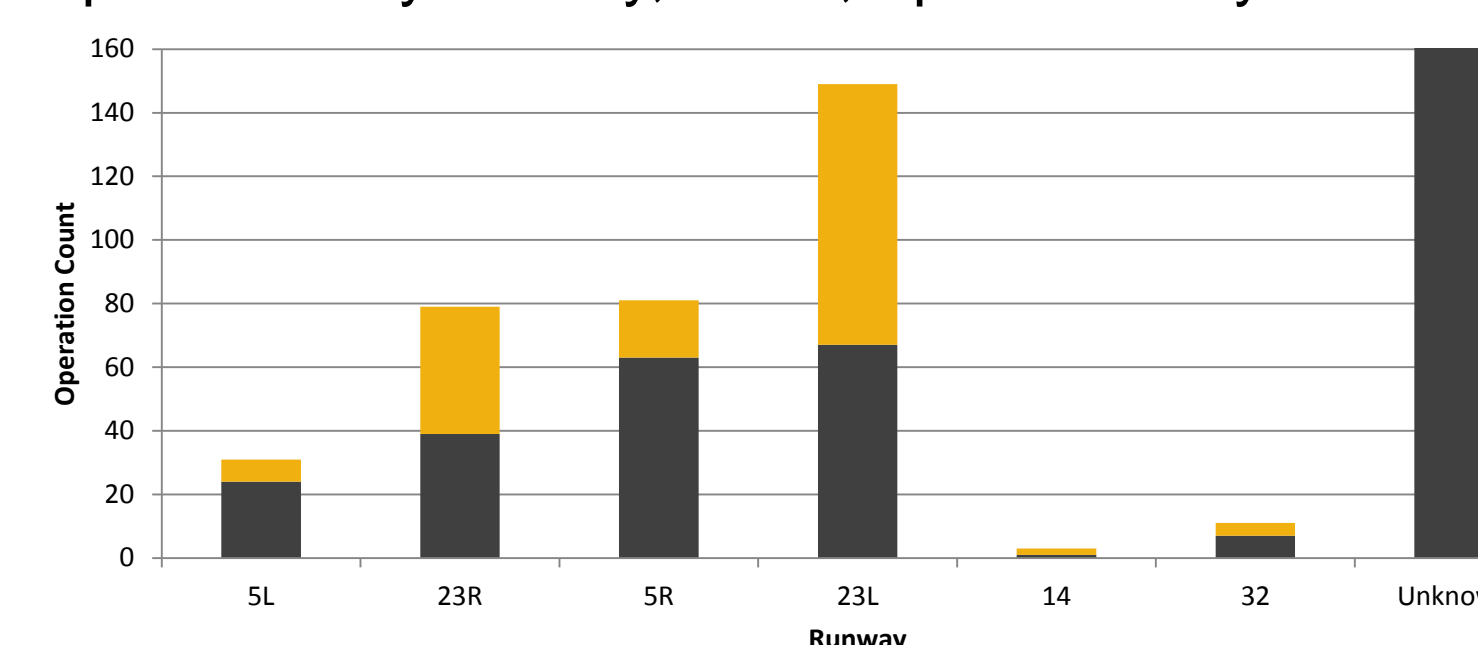
Operations by runway, KLAF, Apr. 27 – May 3



Operations by hour of day, KLAF, Apr. 27 – May 3



Operations by runway, KIND, Apr. 27 – May 3



ADS-B Penetration

The analysis that can be done with aircraft transponder data is greatly augmented by ADS-B (Mode S Extended) data. The graphs below compare ADS-B to Mode S transmissions for three airports

- LAF – Purdue University Airport
- IND – Indianapolis International Airport
- CDG – Charles du Gaulle International Airport, Paris, France

